A Giant Step: from Milli- to Micro-arcsecond Astrometry
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CTIO 0.9m observations of ICRF optical counterparts

Marion I. Zacharias[1]
and Norbert Zacharias[1]

[1]U. S. Naval Observatory, 3450 Mass. Ave. NW, Washington, DC 20392, USA
email: miz@usno.navy.mil, nz@usno.navy.mil

Abstract. We present astrometric results from 7 observing runs at the Cerro Tololo Interamerican Observatory (CTIO) 0.9m telescope of 197 extragalactic reference frame sources, selected from the original International Celestial Reference Frame (ICRF) catalog. This is part of the U.S. Naval Observatory (USNO) reference frame link program. Contemporaneous to the CTIO deep imaging, wide-field CCD data were taken with the USNO Twin Astrogragh to provide accurate secondary reference stars in the 13 to 16 mag range. The optical positions are on the Hipparcos system (via Tycho-2 stars). The unweighted, mean RMS position difference optical−radio for a single source is 28 and 25 mas for RA and Dec, respectively.

Keywords. astrometry, reference systems, catalogs, quasar: general

1. Astrograph reference stars

This reference frame program links Hipparcos and Tycho stars to the defining, optically faint sources in a two-step approach, deep observing (0.9m) and wide-field (USNO Twin Astrograph) observing. For each observing run an individual reference star catalog was constructed with these dedicated, unpublished observations from the USNO Twin Astrograph, with the following advantages with respect to the general UCAC2 (Zacharias, Urban, Zacharias, *et al.* (2004)): there are many more frames per source, the frames are centered on the source, and the telescope was on the east and west side of the pier to compensate for residual systematic errors.

2. Deep frame observations and reductions

Deep frames were observed with the CTIO 0.9m telescope. A summary of deep optical imaging observing runs can be found in Zacharias, Zacharias, Rafferty (2003). A customized filter was used to match the spectral bandpass of the USNO Twin Astrograph. At least 4 frames were taken per source. In addition calibration fields were taken with offsets. So far 128 sources are classified as "good," 18 are optically faint, 27 are potential problem sources (identification confirmed but position offset larger than expected), 23 are empty fields (no optical counterpart visible at the corresponding radio position), and 1 yielded no result (only observing attempt). A faint optical source has a signal/noise ratio of 5 or less. For a potential problem source the (optical−radio) position difference is greater than 3-sigma of the total, estimated errors.

Residuals from the reductions of the deep CCD frames were collected, binned and smoothed to establish a field distortion pattern. These data were then used to correct the x,y data of each deep frame. A linear plate model was adopted for the final, weighted least-squares adjustment of each frame similar to the procedures used for the

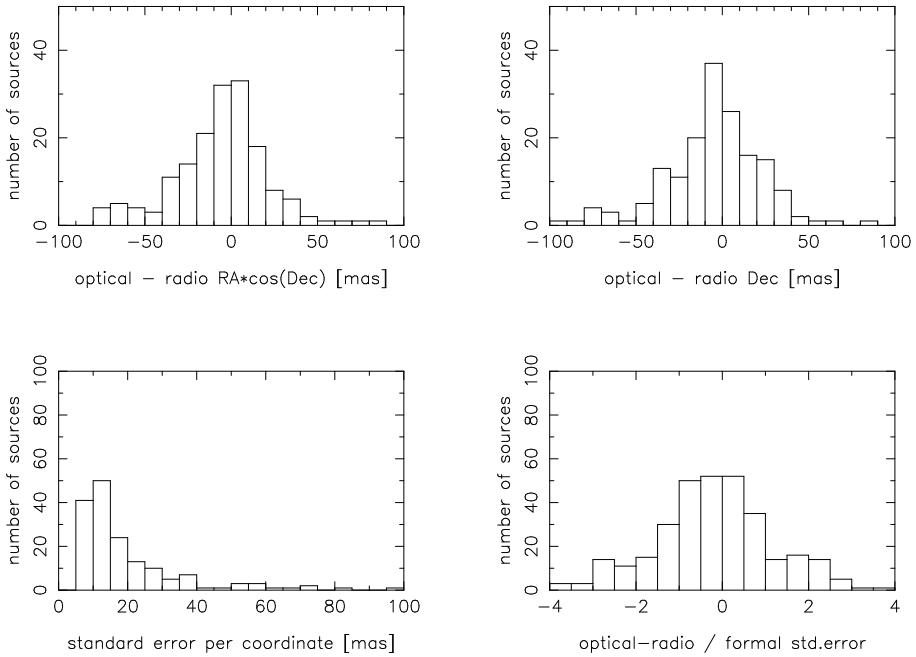

Figure 1. Histograms showing the (optical−radio) position difference distribution and the distribution of total optical position errors.

Kitt Peak National Observatory (KPNO) 2.1m data (Zacharias & Zacharias (2005)). Between roughly 20 and 900 reference stars are on a single frame.

3. Optical−radio results

The unweighted, mean RMS position difference optical−radio for a single source is 28 and 25 mas for RA and Dec, respectively. The mean total error of 146 sources (good + faint) is about 20 mas per coordinate (figure 1).

Acknowledgements

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